

Chemical Nomenclature Unit

Valence Value

The valence value of an element is defined as the number of electrons an atom of that element will gain/lose/share when forming a compound. Elements have a valence value determined by their group on the Periodic table unless otherwise indicated by the name.

1	2		3	4	3	2	1	0

Cross-Over Rule for Writing Formulas

STEPS	sodium chloride	magnesium oxide	calcium fluoride	lithium sulphate	aluminum carbonate
1. Write down the symbols of the elements in the order given in the name.	Na Cl	Mg O	Ca F	Li SO ₄	Al CO ₃
2. Write the valences above the elements symbol.	1 1 Na Cl	2 2 Mg O	2 1 Ca F	1 2 Li SO ₄	3 2 Al CO ₃
3. Divide the valences by the highest common multiple.	1 1 Na Cl	1 1 Mg O	2 1 Ca F	1 2 Li SO ₄	3 2 Al CO ₃
4. Cross-over valences	Na ₁ Cl ₁	Mg ₁ O ₁	Ca ₁ F ₂	Li ₂ (SO ₄) ₁	Al ₂ (CO ₃) ₃
5. Drop all 1's and unnecessary brackets	NaCl	MgO	CaF ₂	Li ₂ SO ₄	Al ₂ (CO ₃) ₃

Notes:

- You should be able to do all 5 steps in your head when you are finished the unit.
- When naming compounds, the least electronegative element is usually written first.
- Groups of elements such as SO₄²⁻ and CO₃²⁻ are referred to as radicals or polyatomic ions. These radicals behave as if they were a single entity and follow the cross over rule in the same manner as other single elements. Brackets are used in the formula only if there are 2 or more of the radical indicated in the formula. For example, brackets are used in Al₂(SO₄)₃ but not Na₂SO₄.

Binary Ionic Compounds

A binary compound contains 2 elements only.

Rules for Binary Ionic Compounds:

- The name of the binary compound always ends in "**ide**".
- The first mentioned element may have more than one valence and if it does this must be indicated in the name.
- If the valence of the first element is not indicated in the name, their valence value is determined by their group on the Periodic table.

A) Binary Compounds where the first element has 1 valence only

Use rule "c" and the cross-over rule. Silver has a valence of 1, zinc and cadmium have a valence of 2.

Examples:

sodium oxide Na₂O

calcium sulfide CaS

magnesium bromide MgBr₂

Exercise: For all exercises give the name if the formula is provided and the formula if the name is provided.

calcium nitride	___Ca ₃ N ₂ ___	KCl	___potassium chloride___
lithium oxide	___Li ₂ O___	MgF ₂	___magnesium fluoride___
aluminum carbide	___Al ₄ C ₃ ___	Ba ₃ P ₂	___barium phosphide___
gallium oxide	___Ga ₂ O ₃ ___	SrI ₂	___strontium iodide___
silver sulphide	___Ag ₂ S___	Cs ₃ P	___cesium phosphide___
zinc silicide	___Zn ₂ Si___	Na ₃ P	___sodium phosphide___
sodium fluoride	___NaF___	Al ₂ S ₃	___aluminum sulfide___
potassium bromide	___KBr___	CaAs	___calcium arsenide___
barium iodide	___BaI ₂ ___	Ga ₂ Te ₃	___gallium telluride___
magnesium chloride	___MgCl ₂ ___	Li ₂ Se	___lithium selenide___
barium carbide	___Ba ₂ C___	BeF ₂	___beryllium fluoride___
cesium phosphide	___Cs ₃ P___	MgI ₂	___magnesium iodide___
rubidium fluoride	___RbF___	Ag ₃ N	___silver nitride___
calcium oxide	___CaO___	ZnO	___zinc oxide___
barium telluride	___BaTe___	RbS	___rubidium sulfide___
calcium selenide	___CaSe___	CsF	___cesium fluoride___
zinc sulfide	___ZnS___	Al ₂ S ₃	___aluminum sulfide___
potassium phosphide	___K ₃ P___	Ga ₂ Se ₃	___gallium selenide___
sodium nitride	___Na ₃ N___	BeI ₂	___beryllium iodide___
rubidium sulfide	___Rb ₂ S___	BaS	___barium sulfide___
magnesium bromide	___MgBr ₂ ___	Rb ₃ N	___rubidium nitride___
calcium nitride	___Ca ₃ N ₂ ___	Ag ₂ S	___silver sulfide___
francium sulfide	___Fr ₂ S___	GaP	___gallium phosphide___
beryllium phosphide	___Be ₃ P ₂ ___	Na ₂ O	___sodium oxide___
gallium bromide	___GaBr ₃ ___	Mg ₂ C	___magnesium carbide___
aluminum fluoride	___AlF ₃ ___	Be ₃ N ₂	___beryllium nitride___
potassium carbide	___K ₄ C___	AlP	___aluminum phosphide___
barium oxide	___BaO___	BaCl ₂	___barium chloride___
sodium arsenide	___Na ₃ As___	K ₂ S	___potassium sulfide___
lithium nitride	___Li ₃ N___	GaI ₃	___gallium iodide___
zinc bromide	___ZnBr ₂ ___	Ba ₃ N ₂	___barium nitride___
zinc phosphide	___Zn ₃ P ₂ ___	Ba ₂ C	___barium carbide___
aluminum oxide	___Al ₂ O ₃ ___	Fr ₂ O	___francium oxide___
cesium bromide	___CsBr___	Cs ₂ S	___cesium sulphide___

B) Binary Compounds with Multivalent Elements

Many transition metals and some other elements have multiple valence values and therefore can form multiple compounds with the same non-metal. Due to this it is necessary to indicate the valence of the metal in the name of the compound using either the Stock (IUPAC or Roman Numeral) method. The second element (non-metal) always has a valence equal to the value as determined from its group in the periodic table. The table of multivalent elements that you have been given must be **MEMORIZED!**

Examples:

iron (III) chloride
cobalt (III) oxide

FeCl_3
 Co_2O_3

tin (IV) iodide
iron (II) oxide

SnI_4
 FeO

Exercise: For all exercises give the name if the formula is provided and the formula if the name is provided.

iron (III) chloride	_____ FeCl_3 _____	Cr_3P_2	_____ chromium (II) phosphide _____
tin (IV) oxide	_____ SnO_2 _____	NiI_2	_____ nickel (II) iodide _____
platinum (IV) nitride	_____ Pt_3N_4 _____	Pb_3N_2	_____ lead (II) nitride _____
copper (I) bromide	_____ CuBr _____	Co_2Se_3	_____ cobalt (III) selenide _____
antimony (V) sulphide	_____ Sb_2S_5 _____	SnO_2	_____ tin (IV) oxide _____
arsenic (III) oxide	_____ As_2O_3 _____	CoF_3	_____ cobalt (III) fluoride _____
gold (I) sulphide	_____ Au_2S _____	AuN	_____ gold (III) nitride _____
antimony (V) oxide	_____ Sb_2O_5 _____	CuO	_____ copper (II) oxide _____
iron (II) phosphide	_____ Fe_3P_2 _____	PtO_2	_____ platinum (IV) oxide _____
cobalt (III) iodide	_____ CoI_3 _____	SnF_4	_____ tin (IV) fluoride _____
gold (I) telluride	_____ Au_2Te _____	CrO	_____ chromium (II) oxide _____
iron (III) oxide	_____ Fe_2O_3 _____	Ni_2O_3	_____ nickel (III) oxide _____
lead (IV) phosphide	_____ Pb_3P_4 _____	FeF_3	_____ iron (III) fluoride _____
copper (II) chloride	_____ CuCl_2 _____	PtI_2	_____ platinum (II) iodide _____
gold (III) chloride	_____ AuCl_3 _____	FeI_2	_____ iron (II) iodide _____
copper (II) sulphide	_____ CuS _____	Co_3P_2	_____ cobalt (II) phosphide _____
cobalt (III) oxide	_____ Co_2O_3 _____	SnS	_____ tin (II) sulfide _____
iron (III) oxide	_____ Fe_2O_3 _____	CrI_3	_____ chromium (III) iodide _____
nickel (III) sulfide	_____ Ni_2S_3 _____	NiI_2	_____ nickel (II) iodide _____
copper (I) fluoride	_____ CuF _____	AuBr_2	_____ gold (II) bromide _____
tin (IV) fluoride	_____ SnF_4 _____	CoCl_3	_____ cobalt (III) chloride _____
lead (IV) sulfide	_____ PbS_2 _____	Pb_3N_4	_____ lead (IV) nitride _____
gold (II) bromide	_____ AuBr_2 _____	CuO	_____ copper (II) oxide _____
nickel (III) iodide	_____ NiI_3 _____	PbS	_____ lead (II) sulfide _____
chromium (II) oxide	_____ CrO _____	SnSe_2	_____ tin (IV) selenide _____

Formula of Elements

Most elements are written as single entities.

Example: iron Fe_(s) copper Cu_(s) helium He_(g)

The exceptions to this rule are: ** These exceptions must be memorized! **

a) the diatomic gases: **H O F Br I N Cl**

hydrogen H_{2(g)} nitrogen N_{2(g)} fluorine F_{2(g)} iodine I_{2(s)}
oxygen O_{2(g)} chlorine Cl_{2(g)} bromine Br_{2(l)}

b) two other non-metals: sulphur S_{8(s)} phosphorus P_{4(s)}

Common Radicals or Polyatomic Ions

Radicals or polyatomic ions are groups of atoms that are treated as a single entity when writing formulas and names.

The following list of common radicals (polyatomic ions) must be memorized along with their valences. Positive polyatomic ions replace metals in an ionic compound and a negatively charged polyatomic ion goes in place of the non-metal. If more than 1 of the radical is required in the chemical formula, brackets are placed around the radical's formula with the subscript outside the bracket.

Radical name	Formula	Valence	Radical name	Formula	Valence
hydroxide	OH ⁻	1	ammonium	NH ₄ ⁺	1
cyanide	CN ⁻	1	permanganate	MnO ₄ ⁻	1
chromate	CrO ₄ ²⁻	2	dichromate	Cr ₂ O ₇ ²⁻	2
cyanate	CNO ⁻	1	thiocyanate	SCN ⁻	1
carbonate	CO ₃ ²⁻	2	nitrate	NO ₃ ⁻	1
phosphate	PO ₄ ³⁻	3	sulfate	SO ₄ ²⁻	2
fluorate	FO ₃ ⁻	1	chlorate	ClO ₃ ⁻	1

Examples:

sodium hydroxide	NaOH	potassium chromate	K ₂ CrO ₄
lithium cyanide	LiCN	ammonium hydroxide	NH ₄ OH
sodium dichromate	Na ₂ Cr ₂ O ₇	magnesium permanganate	Mg(MnO ₄) ₂

Exercise: For all exercises give the name if the formula is provided and the formula if the name is provided.

potassium hydroxide	____ KOH ____	Ga ₂ (Cr ₂ O ₇) ₃	____ gallium dichromate ____
iron(III) cyanate	____ Fe(CNO) ₃ ____	KCNO	____ potassium cyanate ____
barium hydroxide	____ Ba(OH) ₂ ____	(NH ₄) ₂ SO ₄	____ ammonium sulfate ____
ammonium chloride	____ NH ₄ Cl ____	BaCO ₃	____ barium carbonate ____
copper(II) chromate	____ CuCrO ₄ ____	CuCr ₂ O ₇	____ copper (II) dichromate ____
ammonium dichromate	____ (NH ₄) ₂ Cr ₂ O ₇ ____	Sn(CN) ₄	____ tin (IV) cyanide ____
ammonium chlorate	____ NH ₄ ClO ₃ ____	Fe(FO ₃) ₃	____ iron (III) fluorate ____
iron (III) hydroxide	____ Fe(OH) ₃ ____	Al(OH) ₃	____ aluminum hydroxide ____
nickel(III) cyanide	____ Ni(CN) ₃ ____	KMnO ₄	____ potassium permanganate ____
gold (III) bromide	____ AuBr ₃ ____	CsCN	____ cesium cyanide ____
cobalt(II) cyanate	____ Co(CNO) ₂ ____	Fe(OH) ₂	____ iron (II) hydroxide ____
zinc hydroxide	____ Zn(OH) ₂ ____	Ca(SCN) ₂	____ calcium thiocyanate ____

Practice!! This section has everything that has been covered so far.

calcium fluoride	_____ CaF_2 _____	KOH	_____ potassium hydroxide _____
aluminum iodide	_____ AlI_3 _____	MgF_2	_____ magnesium fluoride _____
argon	_____ Ar _____	$\text{P}_{4(s)}$	_____ phosphorus _____
silver oxide	_____ Ag_2O _____	$\text{Sr}(\text{OH})_2$	_____ strontium hydroxide _____
gold (III) sulphide	_____ Au_2S_3 _____	CsCNO	_____ cesium cyanate _____
lithium phosphide	_____ Li_3P _____	$(\text{NH}_4)_3\text{P}$	_____ ammonium phosphide _____
copper (I) oxide	_____ Cu_2O _____	Au_2S_3	_____ gold (III) sulfide _____
ammonium chromate	_____ $(\text{NH}_4)_2\text{CrO}_4$ _____	CaAs	_____ calcium arsenide _____
copper (I) iodide	_____ CuI _____	$\text{Ga}_2(\text{CO}_3)_3$	_____ gallium carbonate _____
sulfur	_____ S_8 _____	LiSCN	_____ lithium thiocyanate _____
iron (III) chloride	_____ FeCl_3 _____	PbF_2	_____ lead (II) fluoride _____
hydrogen cyanide	_____ HCN _____	MgCr_2O_7	_____ magnesium dichromate _____
tin (IV) fluoride	_____ SnF_4 _____	AgNO_3	_____ silver nitrate _____
copper (II) permanganate	_____ $\text{Cu}(\text{MnO}_4)_2$ _____	$\text{Zn}(\text{OH})_2$	_____ zinc hydroxide _____
lead (II) iodide	_____ PbI_2 _____	PtO_2	_____ platinum (IV) oxide _____
calcium selenide	_____ CaSe _____	$\text{Xe}_{(g)}$	_____ xenon _____
tin (II) sulfide	_____ SnS _____	Ni_2O_3	_____ nickel (III) oxide _____
tin (II) thiocyanate	_____ $\text{Sn}(\text{SCN})$ _____	Ga_2Se_3	_____ gallium selenide _____
cobalt (III) chloride	_____ CoCl_3 _____	BeI_2	_____ beryllium iodide _____
lead (IV) sulfide	_____ PbS_2 _____	$\text{Pt}(\text{SO}_4)_2$	_____ platinum (IV) sulfate _____
copper (I) cyanate	_____ CuCNO _____	Pb_3N_4	_____ lead (IV) nitride _____
calcium nitride	_____ Ca_3N_2 _____	$\text{Sn}(\text{MnO}_4)_2$	_____ tin (II) permanganate _____
neon gas	_____ Ne _____	FeP	_____ iron (III) phosphide _____
iron (III) hydroxide	_____ $\text{Fe}(\text{OH})$ _____	Na_2O	_____ sodium oxide _____
bromine	_____ Br_2 _____	RbCNO	_____ rubidium cyanate _____
cobalt (III) bromide	_____ CoBr_3 _____	$\text{Ni}(\text{FO}_3)_2$	_____ nickel (II) fluorate _____
potassium permanganate	_____ KMnO_4 _____	CoN	_____ cobalt (III) nitride _____
barium oxide	_____ BaO _____	$\text{Cl}_{2(g)}$	_____ chlorine _____
tin (II) cyanide	_____ $\text{Sn}(\text{CN})_2$ _____	K_2S	_____ potassium sulfide _____
copper (II) dichromate	_____ CuCr_2O_7 _____	CrI_3	_____ chromium (III) iodide _____
nickel (III) bromide	_____ NiBr_3 _____	Bi_3N_5	_____ bismuth (V) nitride _____
zinc phosphate	_____ $\text{Zn}_3(\text{PO}_4)_2$ _____	Ba_2C	_____ barium carbide _____
aluminum oxide	_____ Al_2O_3 _____	Fr_2O	_____ francium oxide _____

Acids

There are three groups of acids: 1. binary acids 2. oxy acids 3. derived oxy acids

1. Binary Acids

This is a very small but common group of acids. The following rules apply to all of the members.

1. All have the prefix "hydro" and end with "ic".
2. All must contain hydrogen as the first element.
3. Use the normal cross-over-rule to determine the formula.
4. All are made by dissolving the gas in water and must be so indicated by using (aq) behind the formula.
5. Have no oxygen in their formula

Examples:

hydrochloric acid $\text{HCl}_{(\text{aq})}$ hydrosulfuric acid $\text{H}_2\text{S}_{(\text{aq})}$ hydrocyanic acid $\text{HCN}_{(\text{aq})}$

Exercise: For all exercises give the name if the formula is provided and the formula if the name is provided.

hydrobromic acid ____ $\text{HBr}_{(\text{aq})}$ ____ hydrotelluric acid ____ $\text{H}_2\text{Te}_{(\text{aq})}$ ____ hydrofluoric acid ____ $\text{HF}_{(\text{aq})}$ ____

hydroiodic acid ____ $\text{HI}_{(\text{aq})}$ ____ hydroselenic acid ____ $\text{H}_2\text{Se}_{(\text{aq})}$ ____ hydrosulfuric acid ____ $\text{H}_2\text{S}_{(\text{aq})}$ ____

2. Oxy Acids

This is a larger group of acids. They are alike in that they all contain H, O and at least one other non-metal element. All members of this group of acids follow the rules below.

1. The name of the acid ends in "ic".
2. The name of the associated radical ends in "ate".
3. The valence value of the associated radical is equal to the number of acidic hydrogens in the acid.
4. Since these acids are made by reacting a non-metal oxide with water, (aq) is not required but may be used.

The following 6 oxy acids and their associated radicals along with their valences must be **memorized**.

Name of the Acid	Formula of the Acid	Name of the associated radical	Formula of the associated radical	valence value for the associated radical
acetic acid	$\text{HC}_2\text{H}_3\text{O}_2$	acetate	$\text{C}_2\text{H}_3\text{O}_2^-$	1
nitric acid	HNO_3	nitrate	NO_3^-	1
fluoric acid	HFO_3	fluorate	FO_3^-	1
carbonic acid	H_2CO_3	carbonate	CO_3^{2-}	2
sulfuric acid	H_2SO_4	sulfate	SO_4^{2-}	2
phosphoric acid	H_3PO_4	phosphate	PO_4^{3-}	3

NOTE:

Using the periodic table it is possible to write the names and formulas for a number of other oxy acids using the fact that members of the same chemical family have similar chemical properties. Elements of the same chemical family (group) follow the pattern of the memorized oxy acid immediately above the element of interest.

Example: memorized acid: fluoric acid = HFO_3
 therefore: chloric acid = HClO_3 iodic acid = HIO_3 bromic acid = HBrO_3

If hydrogen is joined with the radicals learned earlier a few more acids can be formed.

chromate = CrO_4^{2-} chromic acid = H_2CrO_4 cyanate = CNO^- cyanic acid = HCNO

Exercise: Complete the following chart for the acids listed.

Name of the acid	Formula of the acid	Name of the associated radical	Formula of the associated radical	Valence value of the associated radical
fluoric acid				
chloric acid				
bromic acid				
iodic acid				
sulfuric acid				
selenic acid				
telluric acid				
carbonic acid				
silicic acid				
phosphoric acid				
arsenic acid				

3. Derived Oxy Acids

These acids are all derived from the parent oxy acids which you are to memorize. The table below shows the rule to determine the derived oxy acids from the parent acid. When adding or removing oxygen atoms from the parent acid, the number of hydrogens on the acid and the valence of the associated radical **remain the same as the parent**.

	Type of Acid	Associated Radical	Example	
Parent Oxy Acid + 1 O	per_____ic	per_____ate	perchloric acid HClO_4	perchlorate ion ClO_4^-
Parent Oxy Acid	_____ic	_____ate	chloric acid HClO_3	chlorate ion ClO_3^-
Parent Oxy Acid - 1 O	_____ous	_____ite	chlorous acid HClO_2	chlorite ion ClO_2^-
Parent Oxy Acid - 2 O	hypo_____ous	hypo_____ite	hypochlorous acid HClO	hypochlorite ion ClO^-

Exercise: Complete the following chart for the acids listed.

Name of the acid	Formula of the acid	Name of the associated radical	Formula of the associated radical	Valence value of the associated radical
phosphoric acid				
phosphorous acid				
hypophosphorous acid				
sulfuric acid				
sulfurous acid				
nitric acid				
nitrous acid				
perchloric acid				
chloric acid				
chlorous acid				
hypochlorous acid				
selenic acid				
selenous acid				
telluric acid				
tellurous acid				

Salts

The word, salt, is the general term given to a class of compounds which can be formed when an acid and a base neutralize each other. According to this definition then, most of the compounds dealt with in the section on binary compounds could be considered to be salts formed from a base and a binary acid. In the same manner, salts are formed from a base and an oxy acid or derived oxy acid.

Examples:

sodium sulphate	Na_2SO_4	calcium phosphate	$\text{Ca}_3(\text{PO}_4)_2$
aluminum carbonate	$\text{Al}_2(\text{CO}_3)_3$	zinc perchlorate	$\text{Zn}(\text{ClO}_4)_2$

Exercise: For all exercises give the name if the formula is provided and the formula if the name is provided.

Salts from oxy acids

sodium nitrate	_____ NaNO_3 _____	$\text{Pb}(\text{TeO}_4)_2$	_____ lead (IV) tellurate _____
iron(III) acetate	_____ $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_3$ _____	NaClO_3	_____ sodium chlorate _____
aluminum silicate	_____ $\text{Al}_2(\text{SiO}_3)_3$ _____	GaAsO_4	_____ gallium arsenate _____
magnesium phosphate	_____ $\text{Mg}_3(\text{PO}_4)_2$ _____	CaSeO_4	_____ calcium selenate _____
gold (I) sulfate	_____ Au_2SO_4 _____	$\text{Mg}_3(\text{AsO}_4)_2$	_____ magnesium arsenate _____
ammonium chlorate	_____ NH_4ClO_3 _____	K_2CO_3	_____ potassium carbonate _____
zinc nitrate	_____ $\text{Zn}(\text{NO}_3)_2$ _____	Na_3PO_4	_____ sodium phosphate _____
potassium acetate	_____ $\text{KC}_2\text{H}_3\text{O}_2$ _____	CuSiO_3	_____ copper (II) silicate _____
lithium arsenate	_____ Li_3AsO_4 _____	$\text{Pb}(\text{SO}_4)_2$	_____ lead (IV) sulfate _____
calcium nitrate	_____ $\text{Ca}(\text{NO}_3)_2$ _____	$\text{Fe}(\text{ClO}_3)_2$	_____ iron (II) chlorate _____
iron (III) sulfate	_____ $\text{Fe}_2(\text{SO}_4)_3$ _____	$\text{Cr}(\text{BrO}_3)_2$	_____ chromium bromate _____
gold (I) phosphate	_____ Au_3PO_4 _____	$\text{Al}(\text{C}_2\text{H}_3\text{O}_2)_3$	_____ aluminum acetate _____
magnesium chlorate	_____ $\text{Mg}(\text{ClO}_3)_2$ _____	SnTeO_4	_____ tin (II) tellurate _____
ammonium nitrate	_____ NH_4NO_3 _____	NH_4IO_3	_____ ammonium iodate _____
lithium bromate	_____ LiBrO_3 _____	Na_2CO_3	_____ sodium carbonate _____
iron (II) iodate	_____ $\text{Fe}(\text{IO}_3)_2$ _____	AgIO_3	_____ silver iodate _____
nickel (III) selenite	_____ $\text{Ni}_2(\text{SeO}_3)_3$ _____	$\text{Co}(\text{BrO}_3)_3$	_____ cobalt (III) bromate _____
barium silicate	_____ BaSiO_3 _____	Li_2SiO_3	_____ lithium silicate _____
cobalt (III) carbonate	_____ $\text{Co}_2(\text{CO}_3)_3$ _____	$\text{Ca}(\text{FO}_3)_2$	_____ calcium fluorate _____
sodium tellurite	_____ Na_2TeO_3 _____	$\text{Sn}_3(\text{PO}_4)_2$	_____ tin (II) phosphate _____
chromium (II) sulfate	_____ CrSO_4 _____	K_3AsO_4	_____ potassium arsenate _____
copper (I) fluorate	_____ CuFO_3 _____	$\text{Fe}(\text{ClO}_3)_2$	_____ iron (II) chlorate _____
beryllium phosphate	_____ $\text{Be}_3(\text{PO}_4)_2$ _____	BeSO_4	_____ beryllium sulfate _____
tin (IV) selenate	_____ $\text{Sn}(\text{SeO}_4)_2$ _____	Na_2TeO_4	_____ sodium tellurate _____
silver arsenate	_____ Ag_3AsO_4 _____	$\text{Cu}(\text{BrO}_3)_2$	_____ copper (II) bromate _____
nickel (II) carbonate	_____ NiCO_3 _____	LiNO_3	_____ lithium nitrate _____

Salts from Derived Oxy Acids

aluminum sulfite	___ Al_2SO_3 ___	CaSeO_3	___ calcium selenite ___
cobalt (III) chlorite	___ $\text{Co}(\text{ClO}_2)_3$ ___	Na_2CO_2	___ sodium carbonite ___
tin (IV) hypochlorite	___ $\text{Sn}(\text{ClO})$ ___	$\text{Ba}(\text{IO}_2)_2$	___ barium iodite ___
sodium phosphite	___ Na_3PO_3 ___	$\text{Ni}_2(\text{TeO}_2)_3$	___ nickel (III) hypotellurite ___
aluminum nitrite	___ $\text{Al}(\text{NO}_2)_3$ ___	NaBrO	___ sodium hypobromite ___
cobalt (II) hypophosphite	___ $\text{Co}_3(\text{PO}_2)_2$ ___	LiNO_2	___ lithium nitrite ___
tin (IV) perchlorate	___ $\text{Sn}(\text{ClO}_4)_4$ ___	$\text{Au}(\text{NO}_2)_3$	___ gold (III) nitrite ___
sodium sulphite	___ Na_2SO_3 ___	NH_4ClO_4	___ ammonium perchlorate ___
aluminum chlorite	___ $\text{Al}(\text{ClO}_2)_3$ ___	CuSiO_2	___ copper (II) silicite ___
nickel (III) hypochlorite	___ $\text{Ni}(\text{ClO})_3$ ___	KFO	___ potassium hypofluorite ___
tin(IV) phosphite	___ $\text{Sn}_3(\text{PO}_3)_4$ ___	$\text{Sn}(\text{IO}_4)_4$	___ tin (IV) periodate ___
copper (I) permanganate	___ CuMnO_4 ___	$\text{Ga}(\text{BrO}_4)_3$	___ gallium perbromate ___
ammonium hypophosphite	___ $(\text{NH}_4)_3\text{PO}_2$ ___	$\text{Pb}(\text{ClO})_4$	___ lead (IV) hypochlorite ___
sodium perchlorate	___ NaClO_4 ___	ZnSeO_3	___ zinc selenite ___
calcium selenite	___ CaSeO_3 ___	Ag_2SO_2	___ silver hyposulfite ___
potassium hypoarsenite	___ K_3AsO_2 ___	FeSO_2	___ iron (II) hyposulfite ___
iron (III) nitrite	___ $\text{Fe}(\text{NO}_2)_3$ ___	KNO_2	___ potassium nitrite ___
cesium hyposulfite	___ Cs_2SO_2 ___	CoAsO_4	___ cobalt (III) arsenate ___
lithium tellurite	___ Li_2TeO_3 ___	BaSO_4	___ barium sulfate ___
zinc hypophosphite	___ $\text{Zn}_3(\text{PO}_2)_2$ ___	CsClO_3	___ cesium chlorate ___
cobalt (III) bromite	___ $\text{Co}(\text{BrO}_3)_3$ ___	$\text{Rb}(\text{FO}_3)_2$	___ rubidium fluorate ___
cesium periodate	___ CsIO_4 ___	FeSiO_3	___ iron (II) silicate ___
barium fluorite	___ $\text{Ba}(\text{FO}_2)_2$ ___	K_2SeO_4	___ potassium selenate ___
lead (II) phosphite	___ $\text{Pb}_3(\text{PO}_3)_2$ ___	Cu_2CO_3	___ copper (I) carbonate ___
aluminum arsenite	___ AlAsO_3 ___	GaPO_3	___ gallium phosphite ___
beryllium hypofluorite	___ $\text{Be}(\text{FO})_2$ ___	NaBrO	___ sodium hypobromite ___
chromium (III) nitrite	___ $\text{Cr}(\text{NO}_2)_3$ ___	BeSO_2	___ beryllium hyposulfite ___
gallium hypophosphite	___ GaPO_2 ___	Li_2CO_2	___ lithium carbonite ___
sodium bromite	___ NaBrO_2 ___	$\text{Co}(\text{BrO}_4)_3$	___ cobalt (III) perbromate ___
potassium selenite	___ K_2SeO_2 ___	KClO_2	___ potassium chlorite ___
copper (I) carbonite	___ Cu_2CO_2 ___	AgIO_2	___ silver iodite ___
tin (II) silicite	___ SnSiO_2 ___	$\text{Zn}_3(\text{PO}_4)_2$	___ zinc phosphate ___
magnesium sulfite	___ MgSO_3 ___	$(\text{NH}_4)_3\text{PO}_2$	___ ammonium hypophosphite ___

Practice!! This section has everything that has been covered so far.

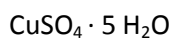
calcium fluoride	_____	BaSiO ₃	_____
aluminum hydroxide	_____	Ni ₃ N ₂	_____
sulfuric acid	_____	H ₂ Se _(aq)	_____
chromium (II) iodite	_____	Na ₃ PO ₄	_____
tin (II) fluoride	_____	Sn ₃ P ₄	_____
ammonium hypobromite	_____	NH ₄ OH	_____
aurous cyanide	_____	AgNO ₃	_____
iron (II) sulfite	_____	Mg(FO ₃) ₂	_____
chromium (III) oxide	_____	CaClO ₂	_____
hydrofluoric acid	_____	Sr(IO ₃) ₂	_____
carbonic acid	_____	BeSeO ₃	_____
calcium sulfate	_____	S _{8(s)}	_____
zinc hydroxide	_____	PbS ₂	_____
strontium dichromate	_____	Fe(MnO ₄) ₂	_____
lithium hypoiodite	_____	SrCrO ₄	_____
magnesium silicate	_____	P _{4(s)}	_____
zinc phosphide	_____	Zn(PO ₄) ₃	_____
barium hydride	_____	H _{2(g)}	_____
potassium permanganate	_____	CaCO ₃	_____
sodium chromate	_____	FeBr ₃	_____
plumbic cyanate	_____	AgIO	_____
lead (IV) thiocyanate	_____	SnO ₂	_____
potassium cyanide	_____	H ₃ PO _{2(aq)}	_____
sodium nitrite	_____	PbSO ₄	_____
fluorine	_____	H ₂ S _(aq)	_____
cobalt (II) sulfite	_____	MgNO ₂	_____
lead (IV) bromite	_____	H ₂ SeO ₃	_____
zinc hypophosphite	_____	AlAsO ₂	_____
nitrous acid	_____	N _{2(g)}	_____

Hydrates

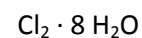
Hydrates are crystals containing a given number of water molecules within their structure. When naming a hydrate Greek prefixes in front of the word hydrate are used to indicate the number of water molecules into the crystal. In the chemical formula the number of water molecules is separated from the formula of the compound by a dot “.”

Examples:

copper(II) sulfate pentahydrate

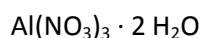


chlorine octahydrate

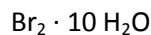
**Exercise:**

For all exercises you will give the name if formula provided and the formula if the name is provided.

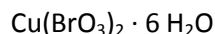
calcium sulfate dihydrate



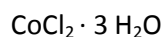
magnesium sulfite heptahydrate



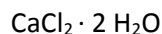
sodium carbonate decahydrate



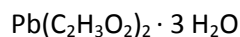
aluminum oxide monohydrate



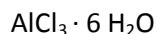
iron (III) chloride hexahydrate



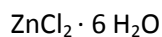
calcium nitrate trihydrate



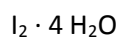
zinc bromide tetrahydrate



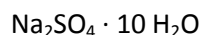
chromium(III) nitrate nonahydrate



cobalt(II) perchlorate pentahydrate



barium chloride dihydrate



Practice!! This section has everything that has been covered so far.

sodium chloride



silver chlorate



calcium perbromate



barium phosphide



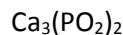
nickel (II) cyanide



cesium peroxide



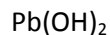
beryllium phosphate



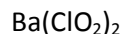
zinc sulfite



calcium carbonate



cesium bromide



iodine monohydrate



tin (IV) carbide



calcium hydroxide



potassium sulfate



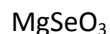
hypocarbonous acid



copper (II) perchlorate



gold (III) selenite



SCH 4C

Name: _____

tin (II) phosphide _____

 $S_8(s)$ _____

hydroiodic acid _____

 $BaCl_2 \cdot 3 H_2O$ _____

copper (I) phosphite _____

 $Zn(BrO_2)_2$ _____

copper (II) sulfate pentahydrate _____

 $HNO_2(aq)$ _____

zinc tellurite _____

 $H_2SeO_4(aq)$ _____

hydrochloric acid _____

 $Sn_3(AsO_2)_4$ _____

lithium hypofluorite _____

 $CoI_3 \cdot 10 H_2O$ _____

magnesium silicate _____

 $ZnCO_3$ _____

potassium sulfide _____

KBr _____

hydrofluoric acid _____

 $(NH_4)_2SO_3$ _____

lithium phosphide _____

CsH _____

magnesium hypochlorite _____

 $NiBr_2$ _____

calcium oxide _____

 $KMnO_4$ _____

sodium carbonate _____

 $Al_2(TeO_2)_3$ _____

chromium (III) sulfide _____

 $HFO(aq)$ _____

potassium oxide _____

 $Ga(OH)_3$ _____

barium sulfide _____

 $Ba_3(PO_3)_2$ _____

magnesium fluoride heptahydrate _____

 $KBrO_4$ _____

silicic acid _____

 $Pb(C_2H_3O_2)_4$ _____

cobalt (III) bromide _____

 $P_4(s)$ _____

zinc hydride dihydrate _____

 $H_2S(aq)$ _____

perchloric acid _____

 $HNO_3(aq)$ _____

strontium chloride _____

 Mg_3N_2 _____

silver sulfide _____

 Na_2SO_3 _____

iron (III) sulfite _____

NiN _____

chlorous acid _____

 $Br_2(l)$ _____

argon gas _____

 $LiNO_2$ _____

nickel (III) carbonite _____

 $HC_2H_3O_2(aq)$ _____

lead (IV) nitride _____

 $SrH_2 \cdot 6 H_2O$ _____

copper (II) chloride trihydrate _____

 $AgNO_3$ _____

sulfurous acid _____

 $BaSiO_3$ _____

aluminum nitride _____

CoO _____

tin (II) hypoiodite _____

 $(NH_4)_2CrO_4$ _____

lead (II) bicarbonite _____

KOH _____

chromium (III) bisulfite _____

 Au_3AsO_3 _____

iodine _____

 $ZnSiO_2$ _____

Molecular Compounds

These compounds contain 2 non-metals and are named using Greek prefixes. This method does not use the valence values. The Greek prefix is placed in front of the element name to indicate how many atoms of the element to place in the formula. If there is only 1 atom of the first element, mono is not used on the name of the first element.

Prefixes

1 = mono 2 = di 3 = tri 4 = tetra 5 = penta 6 = hexa 7 = hepta 8 = octa 9 = nona 10 = deca

Examples:

diphosphorus pentoxide



arsenic trichloride



carbon monoxide



xenon tetrafluoride



Exercise: For all exercises give the name if the formula is provided and the formula if the name is provided.

xenon hexafluoride



sulfur dioxide



sulphur trioxide



carbon dioxide



carbon disulphide



diphosphorus trisulfide



silicon dioxide



carbon tetrachloride



tellurium dioxide



sulfur dioxide



nitrogen dioxide



nitrogen tetroxide



selenium dibromide



carbon tetrabromide



dinitrogen monoxide



bromine trifluoride



dichlorine monoxide



dinitrogen tetrafluoride



diarsenic triselenide



diphosphorus pentasulphide



hexaboron monosilicide



dioxygen difluoride



sulfur dichloride



ditellurium monocarbide



dinitrogen tetrahydride



PRACTICE, PRACTICE, PRACTICE This section contains everything covered in this unit.

sulphur _____
 lead (II) oxide _____
 calcium iodite _____
 sulfur dioxide _____
 gallium hypoarsenite _____
 neon _____
 platinum (IV) thiocarbonite _____
 calcium cyanide heptahydrate _____
 copper (I) permanganate _____
 nitrous acid _____
 silver cyanide _____
 iodine monochloride _____
 tin (IV) hypophosphite _____
 gold (III) oxide _____
 ammonium selenide _____
 titanium _____
 iron (II) silicate _____
 cadmium sulphate _____
 lithium phosphide _____
 bromine _____
 potassium oxide _____
 barium sulfide _____
 magnesium fluoride _____
 gallium bromide _____
 zinc hydride _____
 iron (III) sulfide _____
 chromium (III) oxide _____
 lead (IV) nitride _____
 copper (I) chloride _____
 tin (II) iodide _____
 aluminum nitride _____
 aluminum bromide _____
 tin (IV) sulfide _____

PbSO₃ _____
 MgS _____
 Al₂(SO₂)₃ _____
 Au(CIO₃)₃ _____
 C₃H₈ _____
 Ba(FO)₂ _____
 ZnTeO₄ _____
 Co(NO₃)₃ _____
 RbOH _____
 H₂S_(aq) _____
 SrCl₂·8 H₂O _____
 NiP _____
 Cr(NO₃)₃ _____
 K₂O _____
 Al(CIO₄)₃ _____
 Ga₂(SiO₃)₃ _____
 P₂S₃ _____
 HNO_{3 (aq)} _____
 FeCr₂O₇ _____
 CuSO₄·5H₂O _____
 H₂SeO_{3 (aq)} _____
 CaCr₂O₇ _____
 P₂O₅ _____
 Cr(BrO)₂ _____
 MgO _____
 Al₂O₃ _____
 HI_(aq) _____
 Au₂(SO₃)₃ · 9 H₂O _____
 SO₃ _____
 Li₂CO₂ _____
 Sr₃N₂ · 3 H₂O _____
 (NH₄)₂SiO₂ _____
 H₂Te_(aq) _____

SCH 4C

Name: _____

silver oxide _____

ammonium hypophosphite _____

calcium phosphide _____

 P_2O_5 _____

iron (II) sulfide _____

 $Sn(SO_4)_2$ _____

sodium phosphide _____

 $FePO_4$ _____

iron (II) nitride _____

 K_3N _____

tin (IV) fluoride _____

 SO_2 _____

sodium hydride _____

 $CuOH$ _____

sodium phosphate _____

 $Zn(NO_2)_2$ _____

barium hydroxide _____

 Au_2S_3 _____

sodium carbonate _____

 $NaOH$ _____

perchloric acid _____

 $H_2SO_3(aq)$ _____

nitrous acid _____

 $H_2S(aq)$ _____

strontium oxide _____

 $H_3PO_4(aq)$ _____

lead (IV) oxide _____

 NH_3 _____

potassium chloride _____

 $LiCN$ _____

beryllium iodide _____

 $Ca(OH)_2$ _____

chromium (III) phosphide _____

 $Fe(OH)_3$ _____

silver sulfide _____

 $H_3P(aq)$ _____

cesium nitride _____

 Na_2CO_3 _____

gold (III) chloride _____

 P_2O_5 _____

iron (II) oxide _____

 CH_4 _____

magnesium tellurite _____

 $FeSO_4$ _____

zinc chromate dihydrate _____

 SiO_2 _____

phosphorous acid _____

 $GaCl_3$ _____

zinc cyanide _____

 $CoBr_2$ _____

sodium sulfate hexahydrate _____

 B_2H_4 _____

iron (III) carbonate _____

 CO _____

magnesium phosphide _____

 $P_4(s)$ _____

fluorine _____

 NH_4Cl _____

chlorous acid _____

 Al_2O_3 _____

dicarbon tetrahydride _____

 KBr _____

hydrosulfuric acid _____

 Li_2S _____

tin (II) nitrite _____

 SnI_2 _____

calcium phosphate _____

 $SnCl_4$ _____

SCH 4C

Cu_2O

CuSO_4

Name: _____

tetracarbon decahydride

nickel (III) perbromate

chlorine dihydrate

copper (II) hypoarsenite

bromic acid

gold (I) hydroxide

barium carbonate

barium chloride

sulfuric acid

chromium (III) cyanate

magnesium phosphate

iron (II) iodide

barium dichromate

phosphorus

periodic acid

tetraphosphorus decaoxide

hydrotelluric acid

ammonium bromide

iron (III) oxide

neon

silver hypoarsenite

copper (II) sulphate pentahydrate

nitric acid

sulfur dioxide

potassium permanganate

zinc chloride

diarsenic pentasulfide

hypophosphorous acid

potassium hydroxide

iron (III) cyanate

barium chromate

ammonium thiocyanate

SCH 4C

Name: _____

potassium dichromate

magnesium tellurite

platinum (IV) silicate

Ag_2Se

$\text{Fe}(\text{OH})_2$

N_2O_4

K_2SO_2

$\text{H}_3\text{AsO}_4 \text{ (aq)}$

$\text{H}_2\text{SiO}_3 \text{ (aq)}$

CaSO_3

N_2S_4

$\text{Au}(\text{IO}_4)_3$

PbO_2

$\text{Mg}(\text{NO}_3)_2$

$\text{H}_2\text{S} \text{ (aq)}$

FePO_3

PCl_5

Rb_2SiO_3

$\text{Ra}_3\text{P}_2 \cdot 7 \text{H}_2\text{O}$

NH_4OH

$\text{HCN} \text{ (aq)}$

$\text{Ni}_3(\text{PO}_3)_2$

$\text{HTeO}_2 \text{ (aq)}$

Cu_2Se

$\text{Ga}(\text{OH})_3$

B_2H_6

BaF_2

$\text{H}_2\text{CO}_3 \text{ (aq)}$

$\text{Pb}(\text{ClO})_2$

$\text{H}_2\text{Se} \text{ (aq)}$

CaTeO_4

C_4H_8

ZnSeO_2

BaF_2

SCH 4C

Name: _____

$\text{H}_2\text{Te}_{(\text{aq})}$

$\text{CoPO}_3 \cdot 4 \text{H}_2\text{O}$

NaBr

$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$

cobalt (III) selenite

tricarbon octahydride

sulfurous acid

silver hypophosphite

bromine

silicon tetrahydride

cesium arsenite dihydrate

magnesium hydroxide

aluminum oxide

silver chlorate

calcium perbromate

barium phosphide

nickel (II) cyanide

beryllium phosphate

calcium sulfite

boron tribromide

silicon carbide

lithium hydroxide

copper (I) perchlorate

gold (III) selenate

tin (IV) phosphide

lead (IV) oxide

sulfur trioxide

hydrogen cyanide

lithium hypoiodite

magnesium silicate

zinc phosphide

aluminum oxide

lithium sulfate

magnesium hypochlorite

SCH 4C

Name: _____

cobalt (III) oxide

strontium nitrate

lead (IV) iodite

zinc chloride

cobalt (III) hypobromite

NaCl

K₂SO₄

Na₂CrO₄

H₂S_(aq)

MgTeO₃

Li₂CO₂

Cu(NO₃)₂

Fe(ClO₄)₂

Ba₂(PO₃)₃

AgBrO

Cr(NO₂)₃

SnCO₃ · 4 H₂O

BaSO₃

SrO

P₂O₅

H₂TeO_{4(aq)}

AgFO₂

AuI₃

Ni₂O₃

Na₃AsO₂

SiO₂

Ca_(s)

Rb₂Cr₂O₇

Pb(MnO₄)₄

HI_(aq)

TeCl₂ · 9 H₂O

H₂SO_{4(aq)}

Zn(OH)₂

SiH₄

SCH 4C

Name: _____

$\text{HC}_2\text{H}_3\text{O}_2$ (aq) _____

$\text{Ca}(\text{MnO}_4)_2$ _____

HNO_2 (aq) _____

Cu_2CrO_4 _____

Cl_2 (g) _____

CsIO _____

chromium (III) oxide _____

iodine monofluoride _____

ammonium perbromate _____

carbon disulphide _____

aluminum hydroxide _____

beryllium sulfite _____

lead (II) phosphite _____

chromic hypophosphite _____

iron (III) phosphite _____

potassium arsenite _____

magnesium sulfite _____

zinc tellurite _____

sodium carbonate _____

cobalt (III) bromite _____

aluminum hydride _____

lead (IV) oxide _____

carbon tetraiodide _____

barium nitrate _____

sodium acetate _____

acetic acid _____

ammonium fluoride decahydrate _____

gold (I) chromate _____

iron (II) hydroxide _____

gallium bromide _____

lead (II) thiocyanate _____

oxygen gas _____

arsenic trihydride _____

ammonium phosphate _____

SCH 4C

Name: _____

phosphorus pentachloride

silver nitrate

calcium chlorite

nickel (III) dichromate

potassium permanganate

silicon dioxide

lithium nitride

HBr_(aq)

CuSO₄ · 5 H₂O

ICl₇

I₂ (s)

NiO

GaAsO₃

Fe₂(CO₃)₃

NH₃

BaCl₂ · 3 H₂O

H₂SeO₃ (aq)

PCl₅

K₂O

H₂Se_(aq)

AlPO₃

BrF₃

LiOH

Si₂Cl₆

Sn(CO₂)₂

H₂SiO₃ (aq)

Fe(OH)₂

(NH₄)₂SiO₃

LiC₂H₃O₂

SnCO₃

H₂SiO₂ (aq)

XeI₄

HF_(aq)

H₂ (g)

SCH 4C

SnO_2

N_2O_4

IBr_7

$\text{P}_4(\text{s})$

HNO_2

CsOH

$\text{Au}(\text{ClO}_2)_2$

Cs_2O

Name: _____
